California Regional Water Quality Control Board
Santa Ana Region

April 4, 2003

Item: **15**

Subject: **RESULTS OF ANNUAL WATER QUALITY SAMPLING FOR THE YEAR 2002 – SANTA ANA RIVER BELOW PRADO DAM**

Summary:

The Basin Plan specifies water quality objectives applicable to Reach 3 of the Santa Ana River (River). To determine compliance with these objectives, the Basin Plan requires that sampling of the River be conducted annually at Prado Dam during base flow conditions.

Regional Board staff conducted the year 2002 sampling over a four-week period during August. The results of the year 2002 sampling program indicate that the River at base flow is meeting Basin Plan objectives for all constituents.

Stream flow at Prado Dam during the sampling period ranged from 217 to 231 cubic feet per second (cfs) and averaged 225 cfs.

Background:

The Santa Ana River is the major source of recharge to the Orange County groundwater basin. The Basin Plan specifies certain water quality objectives applicable to Reach 3 of the River (Mission Boulevard in Riverside to Prado Dam) during base flow. The intent of these objectives is to protect the River's groundwater recharge beneficial use. Compliance with these objectives is verified by annual measurement of the base flow quality. Base flow is composed of wastewater discharges, non-point source discharges and rising ground water. Storm flow is not a component of base flow, therefore, the River is sampled during the time of the year (August or September) when the influence of storm flow is at a minimum.[1]

Methods:

The sampling program was carried out weekly during the month of August 2002. Each week, an ISCO sequential sampler was deployed to automatically collect a 24-hour composite sample from the River. The composite sample was then analyzed for mineral analyses, including total dissolved solids (TDS), chloride, sulfate, boron, hardness and

[1] In setting the base flow objectives, it was assumed that storm flows that recharge the Orange County groundwater basins would improve the quality of that groundwater. It was also recognized that there could be no assurance that such storm flows would occur each year. Therefore, it was imperative to control base flow quality such that under these worst case conditions (no high quality storm flows), Orange County groundwater quality would remain protected.

electrical conductivity (EC). In addition, three grab samples were collected during the 24-hour period and analyzed for nutrients, chemical oxygen demand (COD). Total organic carbon (TOC) analyses were inadvertently performed on the 24-hour composite samples rather than the grab samples. Orange County Water District (OCWD) graciously volunteered their laboratory and performed all chemical analyses, in light of the fact that the Regional Board's contract for laboratory services had not been finalized at the time of sampling.

Water temperature, dissolved oxygen, pH and EC were measured in the field using a YSI[2] multi-parameter probe each time a grab sample was collected. These measurements were made with calibrated field equipment. Stream flow measurements were obtained from the U.S. Geological Survey after the sampling program was completed.

Orange County Water District (OCWD) also conducts an independent water quality-monitoring program in the Santa Ana River below Prado Dam. Board staff used OCWD's data to compare and confirm the Prado Dam results.

Results and Discussion:

2002

The Prado Dam results for August 2002 for the mineral constituents are tabulated on Table 1. The results on Table 1 indicate that all mineral parameters were below their respective Basin Plan objectives.

The grab sample results and the field measurements are tabulated on Table 2. The total nitrogen concentrations ranged from 3.7 to 5.4 mg/l, with an average concentration of 4.3 mg/l. These results are significantly lower than the Basin Plan objective (10 mg/l) and the 2001 results (average 6.08 mg/l). COD concentrations ranged from 7 mg/l to 18 mg/l, with an average concentration of 12.2 mg/l. The average and the individual concentrations for COD were below the Basin Plan objective of 30 mg/l.

1983 –2002

Table 3 summarizes the yearly averages of various constituents along with their respective water quality objectives over time for the Prado Dam sampling program. The data indicate that the water quality of Reach 3 of the Santa Ana River for these parameters continues to improve.

Graphs depicting the 1983 –2002 data on Table 3 are found on Figures 1 through 9. Of particular interest, Figure 9 depicts total nitrogen concentrations from 1983 to 2002. In recent years (1998-2002) total nitrogen concentrations have been consistently below the Basin Plan objective. The 2002 results for total nitrogen show that same tendency. This may be due to a number of factors including improvements in the wastewater nitrogen discharges as a result of the Regional Board nitrogen control strategies. In addition, both

[2] Mention of trade names does not imply endorsement of these products.

the OCWD and the City of Riverside operate wetland treatment facilities that serve to reduce nitrogen levels in the River and in the City's wastewater effluent.

TDS concentrations over time are shown in Figure 7. TDS concentrations continue to decrease from the elevated concentrations measured in the early 1980s, again likely due to a number of factors, including wastewater treatment or water supply improvements.

Conclusion:

The results of the 2002 Prado Dam sampling program indicate overall compliance with the Basin Plan objectives. Unlike previous years, the data for COD suggest a decline to concentrations that are well below the objective.

TABLE 1
Santa Ana River below Prado Dam
Year 2002 Mineral Analyses

Date	Discharge (cfs)	Conductivity (umhos/cm)	TDS (mg/L)	Total Hardness (mg/L)	Sodium (mg/L)	Chloride (mg/L)	Sulfate (mg/L)	Boron (mg/L)	TOC (mg/L)
8/6/02	231	879	470	224	103.0	108	99.4	0.34	6.92
8/13/02	217	867	492	230	96.0	100	87.3	0.31	5.66
8/20/02	227	876	528	231	92.1	102	88.3	0.30	5.58
Average	**225**	**874**	**497**	**228**	**97.0**	**103**	**91.7**	**0.32**	**6.05**
Basin Plan Objective	-	-	700	350	110	140	150	0.75	-

TABLE 2
Santa Ana River below Prado Dam
Year 2002 Nutrient Analyses

Date	Time	Water Temp. (deg. C)	pH	Total Nitrogen (mg/L)	Electrical Conductivity (umhos/cm)	Dissolved Oxygen (mg/L)	COD (mg/L)
8/5/02	N/A	N/A	N/A	4.1	N/A	N/A	18
8/5/02	12:45 PM	23.93	6.57	4.0	1034	5.1	14
8/6/02	11:00 AM	22.15	7.21	4.1	1019	5.9	10
8/12/02	11:05 AM	23.46	7.16	4.1	1004	4.1*	15
8/12/02	1:17 PM	24.79	7.26	4.2	1003	6.6	8
8/13/02	2:45 PM	25.43	7.64	4.1	999	3.9*	7
8/19/02	10:20 AM	22.13	7.20	3.7	1005	3.0*	17
8/19/02	12:20 PM	32.26	7.20	4.0	1009	3.3*	16
8/20/02	10:50 AM	22.00	7.29	4.1	1012	3.7*	9
8/26/02	11:55 AM	22.60	7.31	5.4	1096	2.3*	11
8/26/02	2:00 PM	24.29	7.36	5.0	1093	2.7*	11
8/27/02	11:20 PM	22.16	7.40	5.2	1107	2.2*	11
Average	-	24.11	7.24	4.3	1035	3.9*	12
Basin Plan Objective	**-**	**-**	**6.5-8.5**	**10**	**-**	**No less than 5**	**30**

N/A = not analyzed
* Value equals or exceeds Basin Plan Objective

TABLE 3
Santa Ana River Base Flow Results for 1983 – 2002

Year	Discharge (cfs)	TDS (mg/L)	Total Hardness (mg/L)	Sodium (mg/L)	Chloride (mg/L)	Sulfate (mg/L)	Boron (mg/L)	Total Nitrogen (mg/L)	COD (mg/L)	TOC (mg/L)
1983	213	716*	356*	91	85	NA	0.30	8.2	86*	NA
1984	128	683	350*	96	116	159*	0.40	7.3	58*	NA
1985	138	682	339	96	115	150*	0.33	9.8	33*	NA
1986	123	656	290	98	110	127	0.25	10.2*	43*	NA
1987	132	641	323	97	97	134	0.45	10.2*	27	NA
1988	134	629	297	102	111	130	0.25	10.3*	38*	NA
1989	127	635	290	102	115	128	0.30	10.2*	31*	9.9
1990	131	640	289	107	117	128	0.36	11.9*	26	9
1991	124	648	281	89	101	114	0.36	10.9*	18	5.3
1992	136	617	282	98	110	108	0.36	10.6*	18	4.9
1993	130	672	288	99	125	128	NA	8.2	30*	NA
1994	119	629	286	101	114	140	0.38	8.6	40*	5.5
1995	141	636	276	91	103	104	0.28	7.5	27	4.8
1996	168	578	250	88	97	106	0.27	9.5	22	5.4
1997	149+	607+	218+	89+	99+	112+	0.36+	6.3+	NA	9.7+
1998	245	524	264	85	96	100	0.30	7.4	30@	4.7
1999	190	586	271	99.5	101	110	0.34	6.3	30*	4.8
2000	186	562	251	105	107	105	0.32	6.7	15	4.7
2001	192	631	276	96.7	109	99	0.33	6.1	14	5.1
2002	252	497	228	97	103	92	0.32	4.3	12	6.1
Basin Plan Objective	**-**	**700**	**350**	**110**	**140**	**150**	**0.75**	**10**	**30**	**-**

***** Value equals or exceeds Basin Plan Objective
N/A = Not analyzed
+ 1997 Calculated results
@ value is for unfiltered sample not to be compared with COD Basin Plan Objective

TABLE 4
Orange County Water District's Year 2002 Monitoring Results

Date	Station Name	Dissolved Oxygen (mg/L)	EC (umho/cm)	PH (units)	Temp. (deg C)	Ammonia Nitrogen (mg/L)	Nitrate Nitrogen (mg/L)	Nitrite Nitrogen (mg/L)	Boron (mg/L)	TOC (mg/L)	Chloride (mg/L)
8/5/02	SAR-BELOWDAM-01	6.35	993	8.50	23.17	0.30	3.43	0.06	0.34	N/A	108
8/6/02	SAR-BELOWDAM-01	N/A	N/A	N/A	N/A	0.20	3.48	0.00	N/A	N/A	N/A
8/8/02	SAR-BELOWDAM-01	8.40	864	8.10	21.20	0.10	3.75	0.07	N/A	N/A	101
8/12/02	SAR-BELOWDAM-01	4.88	1000	8.4	24.57	0.01	3.46	0.06	0.31	N/A	100
8/13/02	SAR-BELOWDAM-01	10.00	856	8.3	23.30	0.01	3.79	0.07	N/A	N/A	N/A
8/19/02	SAR-BELOWDAM-01	3.15	1005	8.1	22.70	.01	3.52	0.06	0.30	N/A	102
8/20/02	SAR-BELOWDAM-01	5.76	932	N/A	22.05	0.01	3.67	0.06	N/A	N/A	N/A
8/26/02	SAR-BELOWDAM-01	2.48	1095	8.3	23.45	0.11	4.38	0.07	0.34	N/A	111
8/27/02	SAR-BELOWDAM-01	N/A	1110	N/A	22.2	0.1	4.33	0.07	N/A	N/A	N/A

@ - value is for unfiltered sample

Figure 1
Total Nitrogen Concentrations at Santa Ana River Below Prado Dam

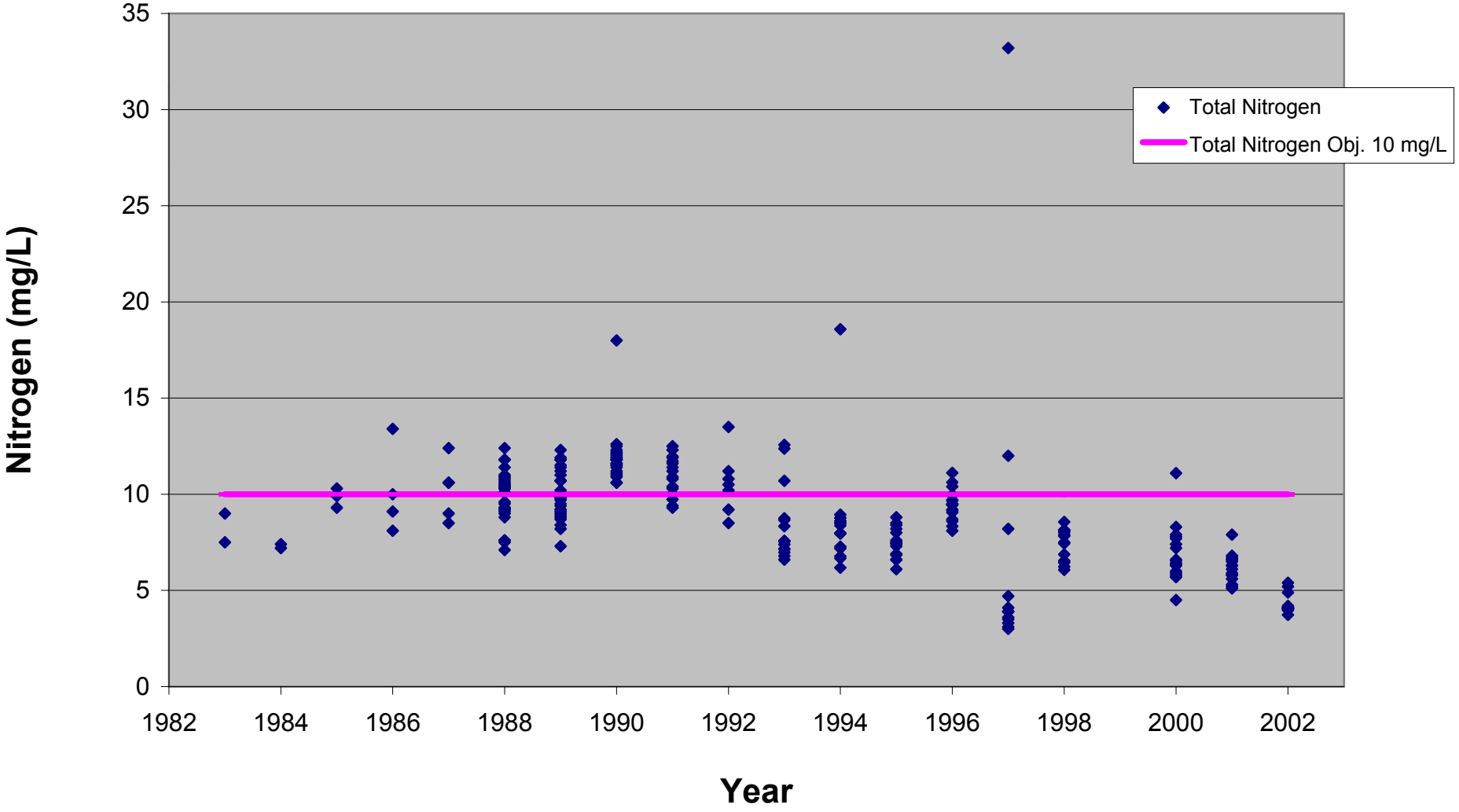

TABLE 1
Santa Ana River below Prado Dam
Year 2002 Mineral Analyses

Date	Discharge (cfs)	Conductivity (umhos/cm)	TDS (mg/L)	Total Hardness (mg/L)	Sodium (mg/L)	Chloride (mg/L)	Sulfate (mg/L)	Boron (mg/L)	TOC (mg/L)
8/6/02	231	879	470	224	103.0	108	99.4	0.34	6.92
8/13/02	217	867	492	230	96.0	100	87.3	0.31	5.66
8/20/02	227	876	528	231	92.1	102	88.3	0.30	5.58
Average	**225**	**874**	**497**	**228**	**97.0**	**103**	**91.7**	**0.32**	**6.05**
Basin Plan Objective	-	-	700	350	110	140	150	0.75	-

TABLE 2
Santa Ana River below Prado Dam
Year 2002 Nutrient Analyses

Date	Time	Water Temp. (deg. C)	pH	Total Nitrogen (mg/L)	Electrical Conductivity (umhos/cm)	Dissolved Oxygen (mg/L)	COD (mg/L)
8/5/02	N/A	N/A	N/A	4.1	N/A	N/A	18
8/5/02	12:45 PM	23.93	6.57	4.0	1034	5.1	14
8/6/02	11:00 AM	22.15	7.21	4.1	1019	5.9	10
8/12/02	11:05 AM	23.46	7.16	4.1	1004	4.1*	15
8/12/02	1:17 PM	24.79	7.26	4.2	1003	6.6	8
8/13/02	2:45 PM	25.43	7.64	4.1	999	3.9*	7
8/19/02	10:20 AM	22.13	7.20	3.7	1005	3.0*	17
8/19/02	12:20 PM	32.26	7.20	4.0	1009	3.3*	16
8/20/02	10:50 AM	22.00	7.29	4.1	1012	3.7*	9
8/26/02	11:55 AM	22.60	7.31	5.4	1096	2.3*	11
8/26/02	2:00 PM	24.29	7.36	5.0	1093	2.7*	11
8/27/02	11:20 PM	22.16	7.40	5.2	1107	2.2*	11
Average	-	24.11	7.24	4.3	1035	3.9*	12
Basin Plan Objective	**-**	**-**	**6.5-8.5**	**10**	**-**	**No less than 5**	**30**

N/A = not analyzed
* Value equals or exceeds Basin Plan Objective

TABLE 3
Santa Ana River Base Flow Results for 1983 – 2002

Year	Discharge (cfs)	TDS (mg/L)	Total Hardness (mg/L)	Sodium (mg/L)	Chloride (mg/L)	Sulfate (mg/L)	Boron (mg/L)	Total Nitrogen (mg/L)	COD (mg/L)	TOC (mg/L)
1983	213	716*	356*	91	85	NA	0.30	8.2	86*	NA
1984	128	683	350*	96	116	159*	0.40	7.3	58*	NA
1985	138	682	339	96	115	150*	0.33	9.8	33*	NA
1986	123	656	290	98	110	127	0.25	10.2*	43*	NA
1987	132	641	323	97	97	134	0.45	10.2*	27	NA
1988	134	629	297	102	111	130	0.25	10.3*	38*	NA
1989	127	635	290	102	115	128	0.30	10.2*	31*	9.9
1990	131	640	289	107	117	128	0.36	11.9*	26	9
1991	124	648	281	89	101	114	0.36	10.9*	18	5.3
1992	136	617	282	98	110	108	0.36	10.6*	18	4.9
1993	130	672	288	99	125	128	NA	8.2	30*	NA
1994	119	629	286	101	114	140	0.38	8.6	40*	5.5
1995	141	636	276	91	103	104	0.28	7.5	27	4.8
1996	168	578	250	88	97	106	0.27	9.5	22	5.4
1997	149+	607+	218+	89+	99+	112+	0.36+	6.3+	NA	9.7+
1998	245	524	264	85	96	100	0.30	7.4	30@	4.7
1999	190	586	271	99.5	101	110	0.34	6.3	30*	4.8
2000	186	562	251	105	107	105	0.32	6.7	15	4.7
2001	192	631	276	96.7	109	99	0.33	6.1	14	5.1
2002	252	497	228	97	103	92	0.32	4.3	12	6.1
Basin Plan Objective	**-**	**700**	**350**	**110**	**140**	**150**	**0.75**	**10**	**30**	**-**

***** Value equals or exceeds Basin Plan Objective
N/A = Not analyzed
+ 1997 Calculated results
@ value is for unfiltered sample not to be compared with COD Basin Plan Objective

TABLE 4
Orange County Water District's Year 2002 Monitoring Results

Date	Station Name	Dissolved Oxygen (mg/L)	EC (umho/cm)	PH (units)	Temp. (deg C)	Ammonia Nitrogen (mg/L)	Nitrate Nitrogen (mg/L)	Nitrite Nitrogen (mg/L)	Boron (mg/L)	TOC (mg/L)	Chloride (mg/L)
8/5/02	SAR-BELOWDAM-01	6.35	993	8.50	23.17	0.30	3.43	0.06	0.34	N/A	108
8/6/02	SAR-BELOWDAM-01	N/A	N/A	N/A	N/A	0.20	3.48	0.00	N/A	N/A	N/A
8/8/02	SAR-BELOWDAM-01	8.40	864	8.10	21.20	0.10	3.75	0.07	N/A	N/A	101
8/12/02	SAR-BELOWDAM-01	4.88	1000	8.4	24.57	0.01	3.46	0.06	0.31	N/A	100
8/13/02	SAR-BELOWDAM-01	10.00	856	8.3	23.30	0.01	3.79	0.07	N/A	N/A	N/A
8/19/02	SAR-BELOWDAM-01	3.15	1005	8.1	22.70	.01	3.52	0.06	0.30	N/A	102
8/20/02	SAR-BELOWDAM-01	5.76	932	N/A	22.05	0.01	3.67	0.06	N/A	N/A	N/A
8/26/02	SAR-BELOWDAM-01	2.48	1095	8.3	23.45	0.11	4.38	0.07	0.34	N/A	111
8/27/02	SAR-BELOWDAM-01	N/A	1110	N/A	22.2	0.1	4.33	0.07	N/A	N/A	N/A

@ - value is for unfiltered sample